

EGS CONFIDENCE TEST EXECUTION COVER SHEET

1. Test ID and Title: AM-1 Contingency Mode Operations Confidence Test - EGS2

2. Test Conductor / Test Lead: Steven War

3. Planned Execution Date: _____

4. Actual Execution Date: _____

5. Planned Configuration:

Hardware: WOTS facilities, S-band sites at Alaska and Norway, GSFC NASCOM, EBnet BLOCKER/DEBLOCKER, EDOS Equipment, EOC Equipment, ETS Workstation, SSIM Workstation, and NCC

Software: EDOS Software, and EOC Software

6. "As Run" Configuration:

7. Package items planned for execution:

(List test cases or steps planned for execution, e.g. ICT10.1, ICT10.2 steps 2-5, etc.)

8. Package items actually executed and deviations from currently published procedures.

9. Results

- a. Capabilities successfully demonstrated
- b. Capabilities not successfully demonstrated
- c. Requirements verified
- d. Discrepancy Reports submitted

10. Lessons Learned

AM-1 Contingency Mode Operations Confidence Test - EGS2

Background Information:

While in contingency mode, (TDRSS unavailable) EDOS does not receive any instrument, i.e. science data. Only the low rate channel housekeeping and playback data will be received. The housekeeping and playback data is sent to the EGS element in the same manner (by EDOS) as during normal mode operations in the form of real-time EDUs and Rate Buffered Data. The message structure and contents for the housekeeping return link data and the forward link data are not affected by the contingency mode (other than different data rates). Whether the contact is via a TDRSS Ground Terminal or via a contingency site ground terminal, EDOS transfers CODA Reports during the contact and a SCS Summary Report upon completion of the spacecraft contact session. At the end of the session, EDOS transmits the Rate Buffered data.

The WOTS, located at Wallops Island, Virginia provides S-band emergency support for TDRSS compatible satellites. The WOTS is managed by the GSFC Suborbital Projects and Operations Directorate (Code 800).

Contingency operations will also use the S-band sites at Alaska & Norway.

Test Objectives:

This test will ensure that the EOC can conduct commanding and telemetry processing operations with the Wallops Orbital Tracking System (WOTS) sites at each rate and format supported by that site. The S-band contingency sites at Alaska and Norway will also be tested. Specifically, this Confidence test will verify:

- the ability of the EOC to command the EOS spacecraft via the contingency configurations.
- the ability to schedule contingency configurations in a real-time contingency basis.
- the ability to execute real-time commands, and stored processor commands at all valid data rates within contingency mode
- the ability to receive telemetry at all valid rates while in contingency mode

Test to ensure the following communication characteristics:

WOTS Return Link Requirements:

Frequency: S-Band

Data Type: VC1, VC3. Real-time housekeeping data is modulated on the carrier and the subcarrier.

Total Bit Rate: Subcarrier: 16 Kbps, Carrier 16 or 512 Kbps.

WOTS Uplink Requirements:

Frequency: S-Band

Data Type: VC0.

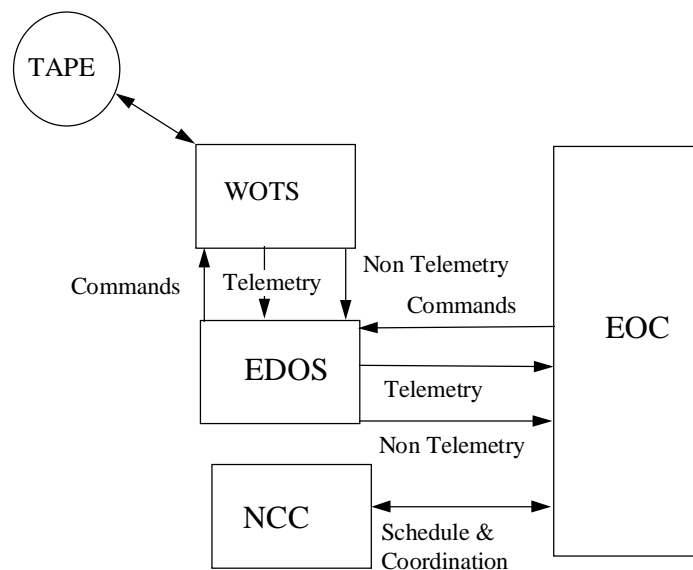
Total Bit Rate: 2 Kbps.

Data Delivery: Real time

Requirements to be Verified:

AM1-0020#B, AM1-0030#B, AM1-0050#B, AM1-0070#B, AM1-0090#B, EOC-2535#B, EOC-4005#A, EOC-4005#B, EOC-4200#A, EOC-4200#B, EOC-5030#B, EOSD0015#B, NI-0210#A, NI-0210#B, NI-0220#A, NI-0220#B, NI-0230#A, NI-0240, & NI-0250. See Appendix A for the text of the requirements.

Test Configuration (Note: in all figures the ground connections are made through EBnet):



WOTS Contingency Mode

Participants and Support Requirements:

Participants:

- WOTS M&O
- GSFC NASCOM M&O
- EDOS M&O
- EOC M&O
- EBnet
- NCC
- ETS
- I&T

Comm:

- Voice: Phone
 - SCAMA and CCL circuits
- Data: GSFC NASCOM MSS
 - EBnet - circuit from GSFC NASCOM to EDOS
 - EBnet - circuit from EDOS to EOC

Equipment & Software:

Hardware:

- WOTS facilities
- GSFC NASCOM
- EBnet BLOCKER/DEBLOCKER
- EDOS Equipment
- EOC Equipment
- ETS Workstation
- SSIM Workstation
- NCC

Software:

- EDOS Software
- EOC Software

Test Tools:

Test Data:

Description / Characteristics	Source	File/Script & Location
Real-time commands (of varying length)	EOC, From test EOC3.4 or generated during test	
Relative Time Commands - to build an RTCS for an instrument	EOC, From test EOC3.4 or generated during test	
Absolute Time Command Table (eg. table containing the TDRS Antenna selection and transmitter configuration for each scheduled real-time contact.)	EOC	
CTIU Commands (relay drive, configuration, management)	EOC	
BDU command message conforming to MIL-STD-1553B message protocol.	EOC, From test EOC3.4 or generated during test	
TDRS position table load	FOT	
CTIU s/w update	AM-1	
SCC s/w update	AM-1	
ASTER Command Table, Data Table, and Instrument S/W Update	ASTER IST or ETS or SSIM	
CERES Command Table, Data Table, and Instrument S/W Update	CERES IST or ETS or SSIM	
MISR Command Table, Data Table, and Instrument S/W Update	MISR IST or ETS or SSIM	
MODIS Command Table, Data Table, and Instrument S/W Update	MODIS IST or ETS or SSIM	
MOPITT Command Table, Data Table, and Instrument S/W Update	MOPITT IST or ETS or SSIM	
Spacecraft tables	ETS or SSIM	
Command data with invalid headers (non-authorization, schedule inconsistency, ...)	EOC	
Critical and/or hazardous commands	EOC, From test EOC3.4 or generated during test	
Stored commands - (Normal, Jump, Halt, NOOP, Activate RTCS)	EOC, From test EOC3.4 or generated during test	
AM-1 real-time data in CCSDS telemetry packets: <ul style="list-style-type: none"> instrument housekeeping telemetry data (16 kbps) 	ETS, SSIM, AM-1 S/C, FOS DMS, or SDPS	TBS

Description / Characteristics	Source	File/Script & Location
<ul style="list-style-type: none"> S/C housekeeping telemetry data (16 kbps) S/C health and safety telemetry data (1 kbps) 		
AM-1 recorded data in CCSDS telemetry packets (downlinked at specified data rates but transmitted by EDOS to EOC at rate-buffered rate): <ul style="list-style-type: none"> instrument housekeeping telemetry data (256 kbps, 512kbps [SSIM and ETS only]) S/C housekeeping telemetry data (256 kbps, 512kbps [SSIM and ETS only]) 	ETS, SSIM, AM-1 S/C, FOS DMS, or SDPS	TBS
SCC memory dump data (1 kbps [all telemetry sources except SSIM], 16 kbps)	ETS, SSIM, AM-1 S/C, FOS DMS, or SDPS	TBS
CTIU memory dump data (1 kbps [all telemetry sources except SSIM], 16 kbps)	ETS, SSIM, AM-1 S/C, FOS DMS, or SDPS	TBS
instrument memory dump data (1 kbps, 16 kbps)	AM-1 instrument, instrument developer, FOS DMS, or SDPS	TBS
CTIU standby telemetry (1 kbps [all telemetry sources except SSIM], 16 kbps)	ETS, SSIM, AM-1 S/C, FOS DMS, or SDPS	TBS

A tape from ETS containing the data in the correct format and data rates will be used for this test. The tape will contain the data as it would be received at each antenna.

References:

AM-1 DMR

GSFC/MO&SAS, 510.2-ICD-EDOS/ASTER, ICD between EDOS and ASTER GDS, January 19, 1996.

GSFC, 505-41-21, IRD between the ECS and the NISS , May 1995.

Test Case Descriptions:

EGS2-1 Contingency mode via WOTS sites

EGS2.1-1 - Real-time Commanding

This test verifies spacecraft and instrument real-time commanding via WOTS at 2 Kbps. FOS capabilities demonstrated during the test include:

- Command validation
- Single msg w/ acknowledge

- 5 ECL w/ acknowledge
- 5 blocks of 64 w/ acknowledge
- CTIU commands (relay drive, configuration, management)
- BDU 1553B command
- Real-time s/c command to activate an RTCS for an instrument
- Verify command execution on-board the spacecraft

EGS2.1-2 - SCC Stored Commands

This test, using spacecraft load commands, verifies the ability to uplink spacecraft and instrument SCC-Stored commands at 2 kbps via WOTS. Utilizing a combination of absolute time commands and relative time commands, the following types of SCC stored commands will be demonstrated:

- Normal
- Jump
- Halt
- NOOP
- Activate RTCS

EGS2.1-3 - SCC Stored Tables

This test, using spacecraft load commands, verifies the ability to uplink spacecraft and instrument SCC-Stored Tables at 2 kbps via WOTS. SCC stored tables include:

- Spacecraft Table
- Instrument Table

EGS2.1-4 - SCC Software Updates

This test, using spacecraft load commands, verifies SCC-Stored Software Updates at 2 kbps via WOTS.

- SCC
- CTIU

EGS2.1-5 - Instrument Loads

This test, using spacecraft load commands, verifies the ability to uplink Instrument Loads (Command Table, Data Table, and Instrument S/W Updates) at 2 kbps via WOTS.

Uplink loads for the following instruments will be demonstrated during the test include:

- ASTER
- CERES
- MISR
- MODIS
- MOPITT

EGS2.1-6 Real-Time Telemetry Processing

This test verifies that the EOC can simultaneously ingest and decommutate real-time S/C and instrument health and safety EDUs, and display the resulting parameter mnemonics and values via WOTS.

- EOC is configured for real-time telemetry processing. The appropriate logical strings are initialized. The display pages for telemetry and event messages, and the report templates are defined.
- EDOS receives telemetry in Channel Access Data Unit (CADU) format from the ETS MPS, SSIM or AM-1 S/C. It extracts the Consultative Committee for Space Data Systems (CCSDS) packets and Command Link Control Words (CLCWs). The CCSDS telemetry packets are processed and converted to EDOS Data Units (EDUs) based on the Application Process Identifier (APID) and the Virtual Channel Identifier (VCID), and the replay flag. EDUs are sent to the EOC via EBnet. Real-time EDUs are transmitted, in real-time, with a minimal propagation delay.
- EOC receives the telemetry in EDUs and extracts the telemetry data. It decommutates the data based on the APID and telemetry decommutation information in the Telemetry ODB.
- Telemetry displays are invoked at an EOC user station. Selected analog and discrete decommutated parameter values with their corresponding mnemonics are shown in display window(s). Every event that has occurred during the decommutation process including the keyboard entries is shown in an event display window. A selected set of displays is printed out.
- Telemetry processing reports are generated. The reports are displayed on-line and printed out for review off-line.
- The telemetry data, and related event and configuration data are forwarded to the FOS DMS for one-day storage then next to the SDPS for permanent archival.

EGS2.1-7 Recorded Telemetry Processing

This test verifies that the EOC can simultaneously ingest and decommutate recorded S/C and instrument health and safety EDUs, and display the resulting parameter mnemonics and values via WOTS.

- EOC is configured for recorded telemetry processing. The appropriate logical strings are initialized. The display pages for telemetry and event messages, and the report templates are defined.
- EDOS receives telemetry in Channel Access Data Unit (CADU) format from the ETS MPS, SSIM or AM-1 S/C. It extracts the Consultative Committee for Space Data Systems (CCSDS) packets and Command Link Control Words (CLCWs). The CCSDS telemetry packets are processed and converted to EDOS Data Units (EDUs) based on the Application Process Identifier (APID) and the Virtual Channel Identifier (VCID), and the replay flag. The recorded EDUs are transmitted at a rate-buffered rate to the EOC via EBnet.
- EOC receives the telemetry in EDUs and extracts the telemetry data. It decommutates the data based on the APID and telemetry decommutation information in the Telemetry ODB.
- Telemetry displays are invoked at an EOC user station. Selected analog and discrete decommutated parameter values with their corresponding mnemonics are shown in display window(s). Every event that has occurred during the decommutation process including the keyboard entries is shown in an event display window. A selected set of displays is printed out.
- Telemetry processing reports are generated. The reports are displayed on-line and printed out for review off-line.
- The telemetry data, and related event and configuration data are forwarded to the FOS DMS for one-day storage then next to the SDPS for permanent archival.

EGS2.1-8 Telemetry Parameter EU Conversion, Limit and Alarm Processing

This test verifies that telemetry parameter limits are checked during decommutation and that violations are handled properly.

- Audible alarms are enabled. EOC receives telemetry that violates red limits (high and low) specified in the Telemetry ODB. The appropriate event message is displayed and related audible alarms sound off. The audible alarm is disabled. The same telemetry is resent to verify the alarm disablement feature.
- EOC receives telemetry that violates yellow limits (high and low) specified in the Telemetry ODB. The appropriate event message is displayed.
- EOC receives telemetry that violates the delta limits, which are specified in the Telemetry ODB, for successive samples of selected telemetry parameters. The appropriate event messages are displayed.
- Each type of EU conversion and limit violation will be exercised for a specified limit set (pre-launch, launch, etc.). Then the limit set will be changed the tests will be repeated.

EGS2-2-1 through 2-8 Contingency mode via S-band at Alaska.

This test will verify the same as the WOTS tests, but use Alaska S-band resources.

EGS2-3-1 through 2-8 Contingency mode via S-band at Norway

This test will verify the same test cases as the WOTS test, but use Norway S-band resources.

Test Procedures:

Test Set-up:

Step	Station	Action	Expected Results	Comments
1.	EOC	Log onto the FOS user workstation and initialize necessary subsystems Record the system configuration on the execution cover sheet	FOS logical string is configured for test execution	
2.	EOC	Bring up event page		

(rest is TBS)

Test Execution:

TBS

EGS2-1 Contingency mode via WOTS site

EGS2-2 Contingency mode via S-band at Alaska.

EGS2-3 Contingency mode via S-band at Norway.

Test Termination:

Step	Station	Action	Expected Results	Comments
1.	EOC	Collect all necessary screen snaps, dumps, etc. needed for post-test analysis and verification		
2.	EOC	Reconfigure the system to pre-test configuration		
3.	EOC	Log off of the FOS user workstation		

Appendix A:

Paragraph ID	Text
AM1-0020#B	The EOC shall have the capability to send (via EDOS/EBnet and the SN, GN, DSN, or WOTS) and the AM-1 spacecraft shall have the capability to receive spacecraft commands in CCSDS CLTUs (as defined in AM-1 ICD 106).
AM1-0030#B	The EOC shall have the capability to send (via EDOS/EBnet and the SN, GN, DSN, or WOTS) and the AM-1 spacecraft shall have the capability to receive instrument commands in CCSDS CLTUs (as defined in AM-1 ICD 106).
AM1-0050#B	The AM-1 spacecraft shall have the capability to send (in CADU format) and the EOC shall have the capability to receive (in EDUs containing CCSDS telemetry packets and CLCWs) real time AM-1 spacecraft and instrument housekeeping telemetry packets (as defined in AM-1 ICD 106) via EDOS/EBnet and the SN, GN, DSN, or WOTS interfaces.
AM1-0070#B	The AM-1 spacecraft shall have the capability to send (in CADU format) and the EOC shall have the capability to receive (in EDUs containing CCSDS telemetry packets) recorded AM-1 spacecraft and instrument housekeeping telemetry packets (as defined in AM-1 ICD 106) via EDOS/EBnet and the SN, GN, DSN, or WOTS interfaces.
AM1-0090#B	The AM-1 spacecraft shall have the capability to send (in CADU format) and the EOC shall have the capability to receive (in EDUs containing CCSDS telemetry packets and CLCWs) AM-1 SCC, CTIU, and instrument microprocessor memory dump telemetry packets (as defined in AM-1 ICD 106) via EDOS/EBnet and the SN, GN, DSN, or WOTS interfaces.
EOC-2535#B	The EOC shall be capable of scheduling the use of the DSN, GN, or WOTS, in the event of an emergency or contingency that prevents communication through the TDRSS.
EOC-4005#A	The EOC shall be capable of transmitting commands to the EOS spacecraft via EDOS using the: a. SN b. GN, DSN, WOTS (for contingency or emergency operations)
EOC-4005#B	The EOC shall be capable of transmitting commands to the EOS spacecraft via EDOS using the: a. SN b. GN, DSN, WOTS (for contingency or emergency operations)
EOC-4200#A	The EOC shall support several uplink rates to the spacecraft, which include at a minimum the following: a. 10 kilobits per second (kbps) (SSA uplink) b. 1 kbps (SMA uplink) c. 125 bits per second (bps) (SSA uplink during contingency operations) d. 2 kbps (emergency operations via S-band DSN link)
EOC-4200#B	The EOC shall support several uplink rates to the spacecraft, which include at a minimum the following: a. 10 kilobits per second (kbps) (SSA uplink) b. 1 kbps (SMA uplink)

	c. 125 bits per second (bps) (SSA uplink during contingency operations) d. 2 kbps (emergency operations via S-band DSN link)
EOC-5030#B	The EOC shall provide the capability to receive and process, non-telemetry data, which includes at a minimum the following: a. Messages from the NCC b. Monitor blocks from the DSN, GN, and WOTS c. Status messages from EDOS
EOSD0015#B	ECS shall use and support the Deep Space Network (DSN), the Ground Network (GN), and the Wallops Orbital Tracking Station (WOTS), via the EDOS/EBnet interface, as backup of the SN, to obtain forward and return link data communications.
NI-0210#A	ECS shall have the capability to communicate with the GN, DSN, and WOTS via the EDOS/Ecom interface.
NI-0210#B	ECS shall have the capability to communicate with the GN, DSN, and WOTS via the EDOS/EBnet interface.
NI-0220#A	ECS shall have the capability to communicate with the GN, DSN, and WOTS for transmitting commands to EOS spacecraft (via the EDOS/Ecom interface). Mission-specific requirements for supporting EOS spacecraft command operations will be documented in the EOS mission-level Detailed Mission Requirements documents.
NI-0220#B	ECS shall have the capability to communicate with the GN, DSN, and WOTS for transmitting commands to EOS spacecraft (via the EDOS/EBnet interface). Mission-specific requirements for supporting EOS spacecraft command operations will be documented in the EOS mission-level Detailed Mission Requirements documents.
NI-0230#A	ECS shall have the capability to interface with the GN, DSN, and WOTS for obtaining return link (telemetry) data from EOS spacecraft (via the EDOS/Ecom interface). Mission-specific requirements for supporting EOS spacecraft telemetry operations will be documented in the EOS mission-level Detailed Mission Requirements documents.
NI-0240	ECS shall have the capability to receive non-telemetry data from the GN, DSN, and WOTS (via the EDOS/Ecom interface). Mission-specific requirements for supporting EOS spacecraft operations will be documented in the EOS mission-level Detailed Mission Requirements documents.
NI-0250	ECS shall be expandable to support the capability to communicate with the DSN and WOTS to schedule support for EOS spacecraft beyond AM-1 (in accordance with NASA policy and procedures).